UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF OHIO
WESTERN DIVISION

STATE OF OHIO, *ex rel.*	:	**CASE NO.: 3:12-CV-154-WHR**
MICHAEL DeWINE	:	
OHIO ATTORNEY GENERAL	:	**JUDGE WALTER H. RICE**
	:	
Plaintiff,	:	
	:	**CONSENT ORDER FOR**
v.	:	**PRELIMINARY INJUNCTION FOR**
	:	**SOURCE CONTROL AND INTERIM**
	:	**ACTION, PLUME DELINEATION**
JOHNSON WELDED PRODUCTS, INC.	:	**AND CHARACTERIZATION, AND**
	:	**FOCUSED FEASIBILITY STUDY AND**
	:	**STAY OF LITIGATION**
Defendant.	:	

Plaintiff, State of Ohio, *ex rel.* Michael DeWine, Ohio Attorney General ("Plaintiff"), having filed the Complaint in this action against Defendant, Johnson Welded Products, Inc., to enforce Ohio's hazardous waste, solid waste, water pollution and nuisance laws found in Ohio Revised Code Chapters 3734, 6111, and 3767 and the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, 42 U.S.C. §9601, et seq. ("CERCLA"); and Plaintiff and Defendant having consented to the entry of this Consent Order for Preliminary Injunction for Source Control and Interim Action, Plume Delineation and Characterization, and Focused Feasibility Study ("COPI");

Now therefore, without trial of any issue of law or fact, without admission of any issues of law or fact, and upon consent of the parties hereto, it is hereby ORDERED, ADJUDGED, and DECREED as follows:

I. JURISDICTION AND VENUE

1. The Court has both personal jurisdiction over the parties to this action and subject matter jurisdiction over the case pursuant to CERCLA, 28 U.S.C. § 2201, 28 U.S.C. § 1367 and Ohio Rev. Code Chapters 3734, 6111, and 3767. The Complaint states a claim upon which relief can be granted against the Defendant under those statutes. Venue is proper in this Court.

II. PERSONS BOUND

2. The terms and provisions of this COPI shall apply to and be binding upon Plaintiff, Defendant, and Defendant's agents, officers, employees, assigns, successors in interest, and any other person acting in concert and/or privity with any of them pursuant to Federal Rule of Civil Procedure 65(d).

3. No change in ownership or corporate status of the Defendant including, but not limited to, any transfer of assets or real or personal property shall in any way alter the Defendant's obligations under this COPI.

III. DEFINITIONS

4. Unless otherwise expressly provided herein, all terms used in this COPI or in any appendices shall have the same meaning as defined in Ohio Rev. Code Chapters 3734, 6111, and 3767 and CERCLA, and the rules promulgated thereunder. Whenever the terms listed below are

used in this COPI or in any appendices, attached hereto and incorporated herein, the following definitions shall apply:

a. "**CERCLA**" shall mean the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, 42 U.S.C. § 9601, et seq.

b. "**Contaminant(s)**" shall mean Volatile Organic Compounds (VOCs).

c. "**Day**" means a calendar day unless expressly stated to be a business day. "Business day" means a day other than a Saturday, Sunday, or state holiday. In computing any period of time under this COPI, where the last day would fall on a Saturday, Sunday, or state holiday, the period shall run until the close of the next business day.

d. "**Defendant**" means Johnson Welded Products, Inc.

e. "**Focused Feasibility Study**" or "**FFS**" shall mean the document submitted pursuant to Section V of this COPI, SCIA/PDC/FFS, and as further described in Appendix B to this COPI, which presents the methodology and results of the feasibility analysis of potential actions for remediation of any VOC ground water contamination which originated at the South Edgewood Avenue facility or which originated at and has emanated from the South Edgewood Avenue facility.

f. "**Future Response Costs**" means all costs, not inconsistent with the NCP, related to the Site that are incurred by Ohio EPA from August 31, 2011 including, but not limited to, payroll costs, contractor costs, travel costs, direct costs, overhead costs, legal and enforcement related costs, oversight costs, laboratory costs, and the costs of reviewing or developing plans, reports, and other items pursuant to this COPI, verifying the Work, or otherwise implementing or enforcing this COPI.

g. "**Ground-water remediation goals**" shall mean those VOC concentrations in groundwater derived through application of the procedures described in the attached Source Control Interim Action Statement of Work (Appendix A).

h. "**NCP**" means the National Oil and Hazardous Substances Pollution Contingency Plan, codified at 40 C.F.R. Part 300 (1990), as amended.

i. "**Ohio EPA**" means the Ohio Environmental Protection Agency and its designated representatives.

j. "**Paragraph**" means a portion of this COPI identified by an arabic numeral or an uppercase or lowercase letter.

k. "**Parties**" means the Defendant and the State.

l. "**Past Response Costs**" means cost incurred by Ohio EPA through August 30, 2011 in the amount of $106,832.47 which Defendant Johnson Welded Products, Inc. has agreed to pay as required by this COPI.

m. "**Plume Delineation**" or "**PD**" shall mean the delineation, based on the groundwater remediation goals, of the horizontal and vertical extent of any VOC ground-water contamination that originated at the South Edgewood Avenue facility or that originated at and has emanated from the South Edgewood Avenue facility. Plume delineation shall be confirmed through sampling, supplemented by other techniques as approved by Ohio EPA.

n. "**Plume Delineation and Characterization/Focused Feasibility Study Work Plan**" or "**PDC/FFS Work Plan**" shall mean the documents submitted pursuant to Section V of this COPI, Performance of Work, and as further described in Appendix B to this COPI, that describe the tasks necessary to perform the Work required by this COPI for plume delineation and feasibility study.

o. "**Plume Delineation and Characterization/Focused Feasibility Study Statement of Work**" or "**PDC/FFS SOW**" shall mean the statement of work for the implementation of plume delineation and feasibility study as set forth in Appendix B to this COPI.

p. "**Section**" means a portion of this COPI identified by a Roman numeral.

q. "**Site**" shall mean Defendant's facility at 625 South Edgewood Avenue, Urbana, Champaign County, Ohio, and any locations where VOC contamination that originated at or resulted from activities conducted at the South Edgewood Avenue facility is present, including any such contamination that has emanated from the South Edgewood Avenue facility.

r. "**Source Areas**" shall mean any contaminated media, including free product that originated at or resulted from activities conducted at the Site which has caused or demonstrates the potential to cause VOC groundwater contaminant concentrations to exceed groundwater remediation goals. For soils and sediments in unsaturated zones, Source Areas for groundwater contamination shall be defined following the procedures identified in Appendix A of this COPI.

s. "**Source Control Interim Actions**" or "**SCIAs**" shall mean those actions taken in order to eliminate, wherever practicable, or otherwise control Source Areas.

t. "**Source Control Interim Action Work Plan**" or "**SCIA Work Plan**" shall mean the documents submitted pursuant to Section V of this COPI, SCIA/PDC/FFS, and as further described in Appendix A to this COPI, which describe the tasks necessary to perform the Work required by this COPI for implementation of Source Control Interim Actions.

u. "**Source Control Interim Action Statement of Work**" or "**SCIA SOW**" shall mean the statement of work for the implementation of the Source Control Interim Actions as set forth in Appendix A to this COPI.

v. "**South Edgewood Avenue facility**" shall mean the property located at 625 South Edgewood Avenue, in the City of Urbana, Champaign County, Ohio which is owned by Defendant.

w. "**State**" means the State of Ohio.

x. "**Volatile Organic Compounds**" ("**VOCs**") shall mean those compounds listed in the United States Environmental Protection Agency publication SW 846, Test Methods for Evaluating Solid Waste, Method 8260, Target Compound List.

y. "**Work**" means all activities the Defendant is required to perform under the SCIA/PDC/FFS (Section V) and Additional Work (Section VI) Sections of this COPI.

IV. STATEMENT OF PURPOSE

5. In entering into this COPI, the mutual objectives of the Parties include (1) completion of a SCIA/PDC/FFS by the Defendant; (2) payment of Response Costs by the Defendant as required by this COPI; (3) a stay of litigation until the SCIA/PDC/FFS is completed and approved by Ohio EPA, and Ohio EPA selects the remedy for the Site; and (4)

good faith efforts to negotiate a final Consent Order after this COPI is terminated.

V. SOURCE CONTROL/INTERIM ACTION, PLUME DELINEATION/CHARACTERIZATION, AND FOCUSED FEASIBILITY STUDY (SCIA/PDC/FFS)

6. The Defendant shall perform the Work in accordance with this COPI including, but not limited to, the SCIA and PDC/FFS SOWs, all relevant guidance documents, and all standards, specifications, and schedules set forth in or developed and approved by Ohio EPA.

7. Compliance With Law

a. All activities undertaken by Defendant pursuant to this COPI shall be performed in accordance with the requirements of all applicable federal, State and local laws and regulations, and in a manner not inconsistent with the NCP.

b. Ohio EPA has determined that activities conducted pursuant to this COPI, if approved by Ohio EPA, would be considered necessary and consistent with the NCP.

c. Where any portion of the Work requires a permit, license or other authorization from Ohio EPA or any other State, federal or local government agency, Defendant shall submit applications in a timely manner and take all other actions necessary to obtain such permits, license or other authorization. This COPI is not, and shall not be construed to be, a permit, license or other authorization issued pursuant to any statute, rule or regulation.

8. Supervising Contractor

All work performed pursuant to this COPI shall be under the direction and supervision of a contractor with expertise in hazardous substance site investigation and remediation. Prior to the initiation of the Work, Defendant shall notify Ohio EPA in writing of the name of the supervising contractor and any subcontractor to be used in performing the Work under this COPI.

9. Submittal of COPI to those persons hired by the Defendant to perform the Work

The Defendant shall provide a copy of the COPI to each key employee, engineer, facility operator, general contractor, laboratory, agent, and/or other key person hired or employed to perform any and all work or services itemized herein. In any agreement with any person that the Defendant employs to conduct any activities or remedial activity at or upon the Site, the Defendant shall provide that the services or Work to be performed must be in accordance with the terms and conditions of this COPI.

10. Within fourteen (14) days of the Effective Date of this COPI, Defendant shall meet with Ohio EPA to discuss the requirements of the Work Plans required under this COPI, unless otherwise mutually agreed to by the Parties.

11. Source Control Interim Action Work Plan and Schedule

a. Within 60 days of the Effective Date of this COPI, unless otherwise specified in writing by Ohio EPA, Defendant shall submit to Ohio EPA a Work Plan for implementation of a SCIA. The SCIA Work Plan shall provide for the determination of the nature and extent of the Source Areas, if any, caused by the disposal, discharge, or release of VOCs that originated at the South Edgewood Avenue facility or that originated at and have emanated from the South Edgewood facility, and for the development, evaluation, design, and implementation of interim actions for the control of the Source Areas.

b. The SCIA Work Plan shall include a schedule which begins with the date of

Ohio EPA's approval of the Work Plan and includes the specified duration for completion of each task to be accomplished.

c. The SCIA Work Plan shall be developed in conformance with the SCIA SOW, Appendix A, and the guidance documents listed in Appendix C to this COPI, attached hereto and incorporated herein.

d. In the SCIA Work Plan, Defendant shall present the technical justification for the proposed omission of any of the tasks of the SCIA SOW. Any omission proposed by the Defendant is subject to the review and approval of Ohio EPA. Defendant may rely upon existing data and/or information to the extent that Defendant can demonstrate that field and laboratory Quality Assurance/Quality Control (QA/QC) procedures acceptable to Ohio EPA were followed in the generation of the data and/or information. Defendant shall include all supporting documentation in the SCIA Work Plan for existing data and/or information and clearly identify the intended use(s) and data quality objectives for such data and/or information. Ohio EPA will evaluate the adequacy of supporting QA/QC documentation and determine the acceptability of all existing data and/or information during review of the draft SCIA Work Plan.

12. Plume Delineation and Characterization/Focused Feasibility Study Work Plan and Schedule.

a. Within sixty (60) days of the Effective Date of this COPI, unless otherwise specified in writing by Ohio EPA, Defendant shall submit to Ohio EPA a Work Plan for PDC/FFS.

b. The PDC/FFS Work Plan shall include a schedule which begins with the date of Ohio EPA's approval of the PDC/FFS Work Plan and includes the specified duration for completion of each task to be accomplished.

c. The PDC/FFS Work Plan shall be developed in conformance with the PDC/FFS SOW, Appendix B, and the guidance documents listed in Appendix C to this COPI, attached hereto and incorporated herein.

d. In the PDC/FFS Work Plan, Defendant shall present the technical justification for the proposed omission of any of the tasks of the PDC/FFS SOW. Any omission proposed by the Defendant is subject to the review and approval of Ohio EPA. Defendant may rely upon existing data and/or information to the extent that Defendant can demonstrate that field and laboratory QA/QC procedures acceptable to Ohio EPA were followed in the generation of the data and/or information. Defendant shall include all supporting documentation in the PDC/FFS Work Plan for existing data and/or information and clearly identify the intended use(s) and data quality objectives for such data and/or information. Ohio EPA will evaluate the adequacy of supporting QA/QC documentation and determine the acceptability of all existing data and/or information during review of the draft PDC/FFS Work Plan.

13. If Ohio EPA determines that any additional or revised guidance documents affect the Work to be performed under this COPI, Ohio EPA will timely notify Defendant in writing and, subject to the Dispute Resolution section of this COPI, the Work Plan(s) and other affected documents shall be modified accordingly.

14. Should Defendant identify an inconsistency between any of the laws, regulations,

guidance documents, and/or SOWs which Defendant is required to follow by this COPI, Defendant shall notify Ohio EPA in writing of each inconsistency and the effect of the inconsistencies upon the Work to be performed. Defendant shall also recommend, along with a supporting rationale justifying each recommendation, the requirement Defendant believes should be followed. Defendant shall implement the affected Work as directed in writing by Ohio EPA.

15. Ohio EPA will review all Work Plans pursuant to the procedures set forth in the Review of Submittals section of this COPI. Upon approval of any Work Plan by Ohio EPA, Defendant shall implement the Work Plan in accordance with the schedules contained therein. Defendant shall submit all plans, reports, or other deliverables required under the approved Work Plan, in accordance with the approved schedule, for review and approval by Ohio EPA pursuant to the Review of Submittals section of this COPI.

16. Health and Safety Plan

Within sixty (60) days of the Effective Date of this COPI, the Defendant shall submit to Ohio EPA for review and comment a health and safety plan developed in conformance with the guidance listed in Appendix C.

VI. ADDITIONAL WORK

17. Ohio EPA or the Defendant may determine that in addition to the tasks defined in the approved SCIA and PDC/FFS Work Plans, additional Work may be necessary to accomplish the mutual objectives of the Parties as provided in the Statement of Purpose Section of this COPI and the SOWs identified in Appendix A and Appendix B. Based on information currently available for the Site, the Work to be performed by the Defendant is the SCIA/PDC/FFS as

defined herein. No other interim actions are contemplated by Ohio EPA as of the entry of this COPI.

18. Within thirty (30) days of receipt of written notice from Ohio EPA that additional Work is necessary, unless otherwise specified in writing by Ohio EPA, Defendant shall submit a Work Plan and schedule for the performance of the additional Work. In addition, Defendant shall submit revisions to any other schedules impacted by the additional Work. If the Defendant disputes the necessity of additional Work, Defendant shall initiate the procedures for dispute resolution set forth in the Dispute Resolution Section of this COPI within fourteen (14) days after receipt of Ohio EPA's notification of the need for additional Work. The additional Work Plan shall conform to the standards and requirements set forth in the documents attached to this COPI as Appendices A, B and C (SOWs and list of relevant guidance documents). Upon approval of the additional Work Plan and schedule by Ohio EPA pursuant to the Review of Submittals Section of this COPI, Defendant shall implement the approved additional Work Plan in accordance with the revised schedules contained therein.

19. If the Defendant determines that additional Work is necessary, the Defendant shall submit a proposal to Ohio EPA to explain what the additional Work is, why the additional Work is necessary, and what impact, if any, the additional Work will have on the SCIA and/or PDC/FFS Work Plan(s) and schedule(s). If Ohio EPA concurs with the request to perform additional Work, the Defendant shall submit an additional Work Plan and schedule for the performance of additional Work. The additional Work Plan shall conform to the standards and requirements set forth in the documents attached to this COPI as Appendices A, B and C. Upon

approval of the additional Work Plan and schedule by Ohio EPA pursuant to the Review of Submittals Section of this COPI, the Defendant shall implement the approved additional Work Plan in accordance with the schedules contained therein.

VII. SAMPLING AND DATA AVAILABILITY

20. Unless otherwise agreed to by the Site Coordinators, the Defendant shall notify Ohio EPA not less than ten (10) days in advance of all sample collection activity. Upon request, the Defendant shall allow split and/or duplicate samples to be taken by Ohio EPA or its designated contractor. Ohio EPA shall also have the right to take any additional samples it deems necessary. Upon request, Ohio EPA shall allow the Defendant to take split and/or duplicate samples of any samples Ohio EPA takes as part of its oversight of the Defendant's implementation of the Work.

21. Within ten (10) days of the Defendant's receipt of a request for sampling, test information or data by Ohio EPA, the Defendant shall submit to Ohio EPA copies of the results of all sampling and/or tests or other data, including raw data and original laboratory reports, generated by or on behalf of the Defendant with respect to the Site and/or the implementation of this COPI. An electronic copy shall also be provided in a format approved by Ohio EPA. The Defendant may submit to Ohio EPA any interpretive reports and written explanations concerning the raw data and original laboratory reports. Such interpretive reports and written explanations shall not be submitted in lieu of original laboratory reports and raw data. Should the Defendant subsequently discover an error in any report or raw data, the Defendant shall promptly notify Ohio EPA of such discovery and provide the correct information.

VIII. ACCESS

22. Ohio EPA and its contractors shall have access at all reasonable times to the Site and any other property to which access is required for the implementation of this COPI, to the extent access to the property is controlled by the Defendant. Access under this COPI shall be for the purposes of conducting any activity related to this COPI including but not limited to the following:

a. Monitoring the Work;

b. Conducting sampling;

c. Inspecting and copying records, operating logs, contracts, and/or other documents related to the implementation of this COPI;

d. Conducting investigations and tests related to the implementation of this COPI, and;

e. Verifying any data and/or other information submitted to Ohio EPA.

23. To the extent that the Site or any other property to which access is required for the implementation of this COPI is owned or controlled by persons other than the Defendant, Defendant shall use its best efforts to secure from such persons access for the Defendant and Ohio EPA and their contractors as necessary to effectuate this COPI. Best efforts shall include holding persons or businesses in control of other properties harmless for and against claims related to Defendant's actions undertaken as required by this COPI and/or, if necessary, payment of a reasonable sum by Defendant to obtain an access agreement for implementation of this COPI. Copies of all access agreements obtained by the Defendant shall be provided to Ohio EPA upon request. If any access required to implement this COPI is not obtained within ninety

(90) days of the entry of this COPI, or within sixty (60) days of the date Ohio EPA notifies the Defendant in writing that additional access beyond that previously secured is necessary, Defendant shall promptly notify Ohio EPA in writing of the steps Defendant has taken to attempt to obtain access. Ohio EPA may, as it deems appropriate, assist Defendant in obtaining access.

24. Notwithstanding any provision of this COPI, the State retains all of its access rights and authorities, including enforcement authorities related thereto, under any applicable statute or regulation including but not limited to Ohio Rev. Code 3734.07, 3734.20, and 6111.05.

IX. DESIGNATED SITE COORDINATORS

25. The Defendant has designated the following as Site Coordinator for the Defendant:

Tim W. Parshall
A.G. Samuelsson Company
Rear 320 South Clairmont Avenue
Springfield, OH 45505

Ohio EPA has designated the following as Site Coordinator for Ohio EPA:

Chuck Mellon, Site Coordinator
Ohio EPA
Division of Environmental Response and Revitalization (DERR)
Southwest District Office
401 East Fifth Street
Dayton, OH 45402-2911

An Alternate Site Coordinator will be designated by the Defendant within seven (7) days of the entry of this COPI. If the designated Site Coordinator or Alternate Site Coordinator is changed, the identity of the successor will be given to the other Party at least seven (7) days before the changes occur, unless impracticable, but in no event later than the actual day the change is made.

26. To the maximum extent practicable, except as specifically provided in this COPI, communications between the Defendant and Ohio EPA concerning the implementation of this COPI shall be made between the Site Coordinators. The Defendant's Site Coordinator shall be available for communications with Ohio EPA regarding the implementation of this COPI, for the duration of this COPI. The Defendant's Site Coordinator or Alternate Site Coordinator shall be present on the Site or on call during all hours of Work at the Site.

27. Without limitation of any authority conferred on Ohio EPA by statute or regulation, the Ohio EPA Site Coordinator's authority includes but is not limited to the following:

a. Directing the type, quantity and location of samples to be collected by Defendant pursuant to an approved Work Plan;

b. Collecting samples pursuant to any Work Plan and in compliance with the requirements of this COPI;

c. Observing, taking photographs, or otherwise recording information related to the implementation of this COPI, including the use of any mechanical or photographic device;

d. Directing that the Work stop whenever the Site Coordinator for Ohio EPA determines that the activities at the Site may create or exacerbate a threat to public health or safety, or threaten to cause or contribute to air or water pollution or soil contamination;

e. Conducting investigations and tests related to the implementation of this

COPI;

f. Inspecting and copying records, operating logs, contracts and/or other documents related to the implementation of this COPI; and

g. Assessing the Defendant's compliance with this COPI.

X. PROGRESS REPORTS AND NOTICE

28. Unless otherwise directed by Ohio EPA, the Defendant shall submit a written progress report to the Ohio EPA by the tenth (10^{th}) day of every month, except upon mutual agreement of the Site Coordinators allowing reports to be submitted quarterly during any period of insignificant activity. At a minimum, the progress reports shall include:

a. A description of the Work performed during the reporting period including an estimate of the percentage of the SCIA and PDC/FFS completed;

b. A list of all target and actual completion dates for each element of activity including project completion;

c. An explanation for any deviation from any applicable schedule;

d. Summaries of all findings and sampling during the reporting period;

e. Summaries of all changes made in the SCIA and PDC/FFS Work Plans during the reporting period, evidencing consultation with Ohio EPA and the date of approval by Ohio EPA for those changes, when necessary;

f. Summaries of all contacts with representatives of the local community, public interest groups or government agencies during the reporting period;

g. Summaries of all problems or potential problems encountered during the reporting period, including those which delay or threaten to delay completion of project milestones with respect to the approved work plan schedule;

h. Summaries of actions taken or planned to rectify such problems;

i. Changes in key personnel during the reporting period;

j. Projected Work for the next reporting period;

k. Upon request, copies of daily reports, inspection reports, sampling data, and laboratory/monitoring data, etc.;

l. The quantity of media treated, removed, or contained pursuant to the reporting requirements, if any, set forth in the SOWs;

m. The disposition of contaminated soil, sediments, and waste material that was treated on or off site, or the disposal location for any quantity of contaminated ground water and/or surface water that was pumped and treated or disposed, if any.

29. Progress reports (one copy only) shall be sent either by e-mail to chuck.mellon@epa.state.oh.us or by U.S. Mail to the person/address listed below. All other documents (two copies) required to be submitted pursuant to this COPI to Ohio EPA shall be sent by U.S. mail to the following agency address(es):

Chuck Mellon
Division of Environmental Response and Revitalization (DERR)
Southwest District Office
401 East Fifth Street
Dayton, OH 45402-2911
chuck.mellon@epa.state.oh.us

All written correspondence to Defendant shall be directed to:

Tim W. Parshall
A.G. Samuelsson Company
Rear 320 South Clairmont Avenue
Springfield, OH 45505

Ohio EPA and Defendant may designate an alternative contact name or address, upon written notification to the other Party and in accordance with the Designated Site Coordinators Section of this COPI, if applicable.

XI. REVIEW OF SUBMITTALS

30. Ohio EPA shall review any work plan, report, or other item required to be submitted pursuant to this COPI. Upon review for conformance with the SOWs and the guidance listed in Appendix A, B and C to this COPI, Ohio EPA may in its sole discretion (subject to the Dispute Resolution section of this COPI): (a) approve the submission in whole or in part; (b) approve the submission upon specified conditions; (c) modify the submission; (d) disapprove the submission in whole or in part, notifying Defendant of deficiencies; or (e) any combination of the above. The results of Ohio EPA's review shall be in writing and provided to the Defendant.

31. In the event of approval, approval upon condition, or modification of any submission by the Ohio EPA, the Defendant shall proceed to take any action required by the submission as approved, conditionally approved, or modified by Ohio EPA. In the event that revisions to submittals requested by Ohio EPA delay the schedules set forth in the Work Plan, the schedules may be adjusted accordingly upon agreement between Ohio EPA and the Defendant.

32. In the event that Ohio EPA initially disapproves a submission, in whole or in part, and notifies the Defendant in writing of the deficiencies identified by Ohio EPA, the Defendant shall within thirty (30) days, or such longer period of time as specified by Ohio EPA in writing, correct the deficiencies and submit the revised submission to Ohio EPA for approval. The revised submission shall incorporate all of the changes, additions, and/or deletions specified by Ohio EPA in its notice of disapproval. Revised submissions shall be accompanied by a letter indicating how and where each of Ohio EPA's comments was incorporated into the submission. Any other changes made to the submission by the Defendant shall also be identified in the letter. To the extent that the Defendant disputes any changes, additions, and/or deletions specified by the Ohio EPA, the Defendant shall initiate the procedures for dispute resolution set forth in the Dispute Resolution Section of this COPI, within fourteen (14) days after receipt of Ohio EPA's disapproval of a submission. Notwithstanding the disapproval, the Defendant shall proceed to take any action required by a non-deficient portion of the submission.

33. In the event that Ohio EPA disapproves a revised submission, in whole or in part, and notifies the Defendant in writing of the deficiencies identified by Ohio EPA, the Defendant shall within thirty (30) days, or such longer period of time as specified by Ohio EPA in writing, correct the deficiencies and incorporate all changes, additions, and/or deletions, and submit the revised submission to Ohio EPA for approval. If the Defendant fails to submit a revised submission incorporating all changes, additions, and/or deletions within thirty (30) days, or such period of time as specified by Ohio EPA in writing, Plaintiff may assert to the Court that the Defendant should be found in breach and/or violation of this COPI. If the Court determines that

the Defendant is in breach and/or violation of this COPI, the State retains the right to seek termination this COPI, perform any additional investigation, conduct a complete or partial SCIA/PDC/FFS and/or enforce the terms of this COPI as provided in the Reservation of Rights Section of this COPI.

34. All work plans, reports, or other items required to be submitted to Ohio EPA under this COPI shall, upon approval by Ohio EPA, be deemed to be incorporated in and made an enforceable part of this COPI. In the event that Ohio EPA approves a portion of a work plan, report, or other item, the approved portion shall be deemed to be incorporated in and made an enforceable part of this COPI. Should Ohio EPA take more than thirty (30) days to review and approve any submittal, and that period of time beyond thirty (30) days causes Defendant to violate any schedule for Work to be completed, that delay in performance of Work shall not be considered a violation of this COPI.

XII. DISPUTE RESOLUTION

35. The Site Coordinators shall, whenever possible, operate by consensus. In the event that there is a dispute about the adequacy of any work plan, report, or other item required to be submitted pursuant to the Additional Work and Review of Submittals Sections of this COPI, the Defendant's Site Coordinator shall have fourteen (14) days from the date the dispute arises to inform Ohio EPA of the dispute. Ohio EPA and the Defendant shall have fourteen (14) days for informal negotiations with respect to the dispute. This informal dispute resolution period may be extended by agreement of Ohio EPA for up to a maximum of thirty (30) additional days. At the end of the informal dispute resolution period, the Defendant will have

fourteen (14) days to institute the formal dispute resolution procedures of this Section by notifying Ohio EPA's Site Coordinator in writing.

36. The Defendant's written notification instituting the formal dispute resolution procedure shall include the technical rationale supporting the Defendant's position. If the Defendant's written notice and technical rationale in support of the position are not received within fourteen (14) days from the end of the informal dispute resolution period, the formal dispute resolution procedures may not be invoked for the disputed issue(s) and the dispute will be considered resolved. Ohio EPA shall have thirty (30) days from the date the Defendant's formal written dispute position is received to respond to Defendant in writing. Ohio EPA's written response shall include the technical rationale supporting Ohio EPA's position. Following the exchange of written positions, the Site Coordinators shall have an additional fourteen (14) days to resolve the formal dispute. If Ohio EPA concurs with the position of the Defendant or an alternate resolution is reached, then the work plan, report, or other items required to be submitted pursuant to this COPI shall be modified accordingly.

37. If Ohio EPA does not concur with the Defendant, Ohio EPA's Site Coordinator shall notify the Defendant in writing. Upon receipt of such written notice, the Defendant shall have fourteen (14) days to forward a written statement of the dispute to the Division of Environmental Response and Revitalization ("DERR") Manager and request a review of the decision regarding the dispute. If the Defendant does not forward such a statement and request within fourteen (14) days, Ohio EPA will adopt the written position of its Site Coordinator and the work plan, report, or other item required to be submitted pursuant to this COPI, or any other

item subject to the dispute resolution procedures of this Section shall be modified accordingly. If the Defendant forwards such a statement and request within fourteen (14) days, the DERR Manager will resolve the dispute based upon and consistent with this COPI, the SOWs, the SCIA or the approved PDC/FFS Work Plans, and other applicable federal and State laws and regulations.

38. In the event the Defendant disputes the decision of the DERR Manager, the parties will seek a settlement conference with the Court to reach a final decision.

39. The pendency of a dispute under this Section shall extend only the time period for completion of the tasks related to the matters in dispute, except that upon mutual agreement of Ohio EPA and the Defendant, any time period may be extended as is deemed appropriate under the circumstances. Elements of the Work not affected by the dispute shall be completed in accordance with applicable schedules and time frames. The opportunity to invoke dispute resolution under the Dispute Resolution Section shall not be available to Defendant unless otherwise expressly provided in this COPI.

XIII. REIMBURSEMENT OF COSTS

40. The Defendant shall reimburse Ohio EPA for agreed Past Response Costs incurred by Ohio EPA in connection with the Site in the amount of $106,832.47 as of August 30, 2011. This amount shall be paid to Ohio EPA as set forth in Paragraph 42 by the following payment schedule:

- a payment of $25,000 thirty (30) days after the Effective Date of this COPI

- a payment of $25,000 by September 1, 2012

- a payment of $25,000 by December 1, 2012

- a payment of $31,832.47 by March 1, 2013

41. For Future Response Costs incurred by Ohio EPA in connection with the Site after August 30, 2011, Ohio EPA will annually submit to the Defendant an itemized invoice of its Response Costs in connection with the Site for the previous year or years. If Ohio EPA fails to submit an annual invoice, Reponse Costs from any previous year will be added to the next annual invoice. Within sixty (60) days of receipt of such itemized invoice, the Defendant shall remit payment for all of Ohio EPA's Response Costs for the previous year or years by certified check payable to "Treasurer, State of Ohio" at the address listed on the invoice. Should the Defendant contest the accuracy of the Response Costs set forth in an itemized statement, or require additional support for such costs, the Defendant may invoke the procedures of the Dispute Resolution Section within fourteen (14) days of receiving the itemized statement. Any Response Costs which the Defendant must pay as a result of dispute resolution shall be paid within thirty (30) days of the resolution of the dispute. In any calendar year, the Defendant may request, but not more frequently than quarterly, an estimate of Response Costs incurred to that date, and Ohio EPA shall provide such estimate, which in no way shall limit any later comprehensive statement of costs of that calendar year.

42. The Defendant shall remit the Past Response required to be paid pursuant to the schedule set forth in paragraph 40 as follows:

a. Payment shall be made by certified check payable to "Treasurer, State of

Ohio" and shall be forwarded to Martha Sexton, or her successor, 30 East Broad Street, 25th Floor, Columbus, Ohio 43215

b. A copy of the transmittal letter and check shall be sent to the Fiscal Officer, DERR, Ohio EPA, P.O. Box 1049, Columbus, Ohio 43216-1049, and to the Site Coordinator and the Assistant Attorney General assigned to this case.

XIV. ACCESS TO INFORMATION

43. Upon request, the Defendant shall provide to Ohio EPA within thirty (30) days, copies of all documents and information within its possession or control, or that of its contractors or agents, relating to the implementation of this COPI, including but not limited to manifests, reports, correspondence, or other documents or information. This provision shall not be a limitation on any request for information to the Defendant by Ohio EPA made under State or federal law for information relating to events or conditions at the Site.

44. The Defendant may assert a claim that documents or other information submitted to Ohio EPA pursuant to this COPI are confidential under the provisions of Ohio Adm. Code 3745-50-30(A) or Ohio Rev. Code 6111.05(A). If no such claim of confidentiality accompanies the documents or other information when it is submitted to Ohio EPA, it may be made available to the public without notice to the Defendant.

45. The Defendant may assert that certain documents or other information are privileged under the attorney-client privilege or any other privilege recognized by State law. If the Defendant makes such an assertion, it shall provide Ohio EPA with the following: (1) the title of the document or information; (2) the date of the document or information; (3) the name

and title of the author of the document or information; (4) the name and title of each addressee and recipient; (5) a general description of the contents of the document or information; and (6) the privilege being asserted by the Defendant.

46. No claim of confidentiality shall be made with respect to any data or reports required to be submitted to Ohio EPA pursuant to this COPI, including but not limited to laboratory reports, and all sampling, analytical, and monitoring data.

47. The Defendant shall preserve for the duration of this COPI and for a minimum of seven (7) years after termination of this COPI, all documents and other information within its possession or control, or within the possession or control of its contractors or agents, which in any way relate to the Work notwithstanding any document retention policy to the contrary. The Defendant may preserve such documents by microfiche or other electronic or photographic device. At the conclusion of this document retention period, the Defendant shall notify Ohio EPA at least sixty (60) days prior to the destruction of these documents or other information; and upon request, shall deliver such documents and other information to Ohio EPA.

48. To the extent not prohibited by statute or regulation, upon request by the Defendant, Ohio EPA shall reasonably provide the Defendant access to public documents related to the Site or to the Work to be performed under this COPI, including but not limited to any data or other information submitted to Ohio EPA by persons other than the Defendant.

XV. STIPULATED PENALTIES

49. In the event that the Defendant violates any of the requirements of this COPI, the Defendant shall immediately and automatically be liable for and shall pay a stipulated penalty

according to the following payment schedule. For each day of each failure to meet a requirement, up to thirty (30) days - One Hundred Dollars ($100.00) per day. For each day of each failure to meet a requirement, from thirty-one (31) days to sixty (60) days - Two Hundred Dollars ($200.00) per day. For each day of each failure to meet a requirement, from sixty-one (61) days to ninety (90) days - Four Hundred Dollars ($400.00) per day. For each day of each failure to meet a requirement, over ninety (90) days - Eight Hundred Dollars ($800.00) per day.

50. Any payment required to be made under the provisions of paragraph 49 of this COPI shall be made by delivering to Plaintiff's counsel a certified check or checks for the appropriate amounts, within forty-five (45) days from the date of the failure to meet the requirement, and every thirty (30) days thereafter as necessary to comply with the requirements of paragraph 49, payable to the order of "Treasurer, State of Ohio," Martha Sexton, or her successor at the Office of the Attorney General of Ohio, Environmental Enforcement Section, 30 East Broad Street, 25th Floor, Columbus, Ohio 43215. The payment of the stipulated penalty shall be accompanied by letter briefly describing the basis of the stipulated penalty and the relevant date(s) of non-compliance, type of violation, deadline or requirement not met and the date upon which the violation occurred. This penalty shall be deposited into the hazardous waste clean-up fund created by Ohio Rev. Code § 3734.28.

XVI. MODIFICATIONS

51. This COPI may be modified by agreement of the Parties. Modifications shall be in writing, signed by counsel for each Party and the authorized representative of the Defendant and memorialized in an order executed and entered by the court. Any such modifications shall

be effective on the date the court enters its order approving such modifications.

XVII. INDEMNITY

52. Defendant agrees to indemnify, save, and hold harmless the State from any and all claims or causes of action arising from, or related to, the implementation of this COPI, including any acts or omissions of the Defendant, its officers, employees, receivers, trustees, agents, or assigns. Said indemnification shall not apply to acts or omissions of the State of Ohio, its employees, agents or assigns at, on, upon, or related to the Site if said acts or omissions are negligent, performed outside the scope of employment or official responsibilities, or performed with malicious purpose, in bad faith, or in a wanton or reckless manner. The State shall not be considered a party to and shall not be held liable under any contract entered into by the Defendant in carrying out the activities pursuant to this COPI. The State agrees to provide notice to the Defendant within thirty (30) days after receipt of any claim that may be the subject of indemnity as provided in this Section, and to cooperate with the Defendant in the defense of any such claim or action against the State.

XVIII. OTHER CLAIMS

53. Nothing in this COPI shall constitute or be construed as a release from any claim, cause of action, or demand in law or equity against any person, firm, partnership, or corporation not a Party to this COPI, including but not limited to, for any liability arising from, or related to, events or conditions at the Site and/or events or conditions at and from facilities located in the Urbana area including, but not limited to, the Grimes Aerospace Company facility located at 515 North Russell Street, the Q3 JMC facility located at 200 Beech Street and the Hall Company

facility located at 420 East Water Street.

XIX. RESERVATION OF RIGHTS

54. The State reserves the right to seek further relief from this or any Court including without limitation further preliminary and/or permanent injunctive relief, civil penalties for the claims in the Complaint, and cost recovery for work beyond this COPI. This reservation explicitly includes the State's right to pursue an order implementing a remedy for contamination at the Site, including without limitation a remediation Order, and to seek recovery of costs for such work. This reservation also explicitly includes the State's right to seek relief for claims for damages to natural resources. Except as provided in Paragraph 55, this COPI does not waive any defenses which the Defendant may have as to such further relief.

55. The State also expressly reserves, and this COPI shall be without prejudice to, any civil or criminal claims, demands, rights, or causes of action, judicial or administrative, the State may have or which may in the future accrue against the Defendant or others, regardless of whether such claim, demand, right or cause of action was asserted in the Complaint. This COPI does not waive defenses that the Defendant may have as to such claims, demands, rights or causes of action set forth in this Paragraph and Paragraph 54, except that the Defendant shall not assert, and may not maintain, any defense or claim based upon the principles of waiver, *res judicata*, collateral estoppel, issue preclusion, claim-splitting, or other defenses based upon any contention that the claims, demands, rights or causes of action raised by the State in the subsequent proceeding were or should have been brought in the instant case.

56. Nothing herein shall limit the authority of the State to undertake any action against any entity, including the Defendant, to eliminate or control conditions which may present a threat to the public health, safety, welfare or environment, and to seek cost reimbursement for any such action.

57. Entering into this COPI, the COPI itself, or the taking of any action in accordance with it does not constitute an admission by the Defendant of any factual or legal matters or opinions set forth herein. The fact that Defendant has agreed to this COPI shall not constitute or be construed as creating, giving rise to, or otherwise asserting the existence of any claim, cause or action, or demand in law or equity in favor of any person, firm, partnership, or corporation not a Party to this COPI for any liability arising from or related to events or conditions at the Site.

58. Defendant reserves all rights that it may have against other persons under all federal, state and local laws, except as may be set forth in a separate agreement or agreements.

XX. STAY OF LITIGATION

59. Other than for the purpose of enforcing compliance with this COPI, the Parties agree that all further proceedings in this case, including but not limited to filing answers and propounding discovery, shall be stayed pending further order of this Court. The Parties reserve the right to move the Court to lift such stay. For purposes of filing answers pursuant to Civil Rule 12, the Defendant shall have sixty (60) days to file answers after the date the stay is lifted.

XXI. RETENTION OF JURISDICTION

60. This Court shall retain jurisdiction of this matter for the purpose of overseeing compliance with and resolving disputes arising under this COPI.

XXII. CONTRIBUTION PROTECTION

61. With respect to matters addressed in this COPI, the Parties agree that the Defendant is entitled to contribution protection as of the Effective Date of this COPI as to any persons who are not Parties to this COPI as is provided by CERCLA Section 113(f)(2), 42 U.S.C. § 9613(f)(2), so long as the Defendant complies with this COPI. The "matters addressed" in this COPI are the SCIA/PDC/FFS Work and all Response Costs paid as required by this COPI.

XXIII. TERMINATION

62. The Parties' obligations under this COPI shall terminate upon the order of the Court. The Parties will jointly apply for termination upon Defendant's receipt of Ohio EPA's approval in writing of the Defendant's written certification to Ohio EPA that all Work required to be performed under this COPI has been completed, the requirement for the payment of Past and Future Response Costs has been completed, and no Stipulated Penalties are owed. The Defendant's certification shall contain the following attestation: "I certify that the information contained in or accompanying this certification is true, accurate, and complete." This certification shall be submitted by the Defendant to Ohio EPA and shall be signed by responsible officials of the Defendant. The termination of the Defendant's obligations under this COPI shall not terminate the Parties' obligations or entitlements under the Reservation of Rights, Access to Information, Indemnity, Other Claims, and Contribution Protection sections of this COPI.

XXIV. NEGOTIATION OF FINAL CONSENT ORDER

63. Upon application for termination of this COPI, the Parties agree to meet and

confer in good faith concerning the negotiation of a consent order which consent order could include, but not necessarily be limited to, a permanent injunction implementing a remedial order for the selected remedy and the payment of Response Costs related to such remedial order. By entering into the COPI, Defendant does not acknowledge that additional remedial work will be required and nothing in this COPI obligates Defendant to agree to or enter into such a remedial order.

XXV. ENTRY OF COPI AND JUDGMENT BY CLERK

64. Upon signing of this COPI by the Court, the clerk is directed to enter it upon the journal and the Parties will be served electronically. Within three (3) days of entering the judgment upon the journal, the clerk is directed to serve upon all Parties notice of the judgment and its Effective Date upon the journal, in the manner prescribed by Rule 5(b) of the Federal Rules of Civil Procedure and note the service in the appearance docket.

XXVI. AUTHORITY TO ENTER INTO THE COPI

65. The signatory for the Defendant represents and warrants that he or she has been duly authorized to sign this document and so bind the Defendant to all terms and conditions thereof, and that he or she submits with this COPI an authenticated and certified resolution from the Defendant establishing that he or she is so empowered.

XXVII. EFFECTIVE DATE

66. This COPI shall be effective upon the date of its entry by the Court (the "Effective Date").

IT IS SO ORDERED AND AGREED.

Unitied States District Judge

APPROVED:

MICHAEL DEWINE
OHIO ATTORNEY GENERAL

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Counsel for Defendant Johnson Welded Products, Inc.

JOHNSON WELDED PRODUCTS, INC.

By: ____________________ 5/31/12

Print Name: Lilli Ann Johnson

Title: President

Appendix A

STATEMENT OF WORK (SOW)
FOR CONDUCTING
SOURCE CONTROL INTERIM ACTION(S)

PURPOSE:

The purpose of conducting the work described herein is to delineate, characterize, and eliminate or otherwise control Source Areas of ground-water contamination which have resulted from the release of contaminants at the Site, and to eliminate or otherwise control any associated pathways of contaminant migration, including the vapor intrusion pathway, that may pose an unacceptable current or potential future risk to human health or the environment. Successful completion of the required work shall be demonstrated through monitoring of ground-water within and immediately downgradient of Source Areas and monitoring of pathways of contaminant migration.

Respondent shall conduct a Focused Site Characterization (FSC) to characterize contaminant Source Areas and any pathways of contaminant migration, determine Site physical characteristics, identify remediation goals, and obtain all other data necessary to design and implement Source Control Interim Actions (SCIAs). Concurrent with the FSC, Respondent shall perform an individual and comparative analysis of potential SCIAs using the criteria identified in this SOW, recommend appropriate SCIAs for the Site, and prepare a Conceptual Design (CD) of the recommended SCIAs. Following Ohio EPA approval of the FSC and the CD reports, Respondent shall design and implement the approved SCIAs, and operate, maintain, and monitor the constructed systems. Respondent may propose the use of modeling and field screening techniques to guide the FSC and the CD and to assist in evaluating contaminant migration pathways. Field analytical data meeting appropriate Data Quality Objectives (DQOs) will be required to verify field screening and modeling results.

The FSC and CD are interactive and are to be conducted concurrently so that the data collected during the FSC influences the evaluation of potential pathways of contaminant migration, the identification of potential SCIAs, and the conceptual design of Respondent's recommended SCIAs. To obtain Ohio EPA approval, Respondent's recommended SCIAs must protect human health and the environment with respect to identified Source Areas and pathways of contaminant migration, comply with all applicable requirements of federal, state and local laws and regulations, minimize cross-media transfer of contaminants, and utilize permanent solutions to the maximum extent practicable.

TASKS:

1. Develop Workplan
2. Conduct field investigations and obtain all other necessary data
3. Design, implement, and monitor SCIAs

DELIVERABLES:

1. Workplan
2. Focused Site Characterization and Conceptual Design Report
3. Pilot/Treatability Study Workplan(s) and Report(s) (as appropriate)
4. Detailed Plans and Specifications
5. Operation, Maintenance and Monitoring Plans
6. Construction Certification Report
7. Monthly Progress Reports

1.0 DEVELOP WORK PLAN

Respondent shall submit a FSC/CD Workplan (Workplan) and supporting documents including a Sampling and Analysis Plan (SAP) consisting of a Field Sampling Plan (FSP) and a Quality Assurance Project Plan (QAPP), and a Health and Safety Plan (HSP). The Workplan and supporting documents (with the exception of the HSP) must be approved by Ohio EPA prior to the initiation of field activities described therein.

1.1 Focused Site Characterization/Conceptual Design Workplan

The Workplan shall be developed in conjunction with the SAP and the HSP although each plan may be submitted under separate cover. The Workplan shall describe in detail all tasks necessary to perform the work required by this SOW, provide a supporting rationale for performing each task in the manner described, identify the materials and procedures required for each task, and describe the work products to be submitted to the Ohio EPA, including required deliverables and meetings with Ohio EPA, and shall comply with federal, state and local laws and regulations which apply to the work to be performed. The Workplan shall provide fixed date schedules for accomplishing the required work through submission of the FSC/CD Report.

The Workplan shall identify and describe potential SCIAs, identifying treatment, removal, or other actions, either singly or in combination, to satisfy the objectives of the AOC, including this SOW. Primary consideration shall be given to potential SCIAs which actively control Source Areas through removal or treatment. The Workplan shall include and describe in detail the data collection activities necessary to delineate Source Areas, identify and evaluate pathways of contaminant migration, and evaluate and recommend potential SCIAs.

Based on a review of existing information, Respondent(s) shall include in the Workplan a summary of the background information for the Site, including geographic location and describing the physiography, hydrogeology, and history of the Site with respect to the use, storage, disposal, and release of contaminants at the Site. The Workplan shall describe any previous response actions conducted by local, state, federal, or private parties; provide a summary of existing data in terms of the physical and chemical characteristics of identified contaminants; describe their distribution among the environmental media; identify known or potential contaminant Source Areas; and identify known or potential contaminant migration pathways and receptors, including the soil vapor migration pathway and any public or private water supply production wells that may potentially be at risk. Based on this information, Respondent(s) shall develop and include in the Workplan a Conceptual Site Model (CSM) which includes known or suspected contaminant Source Areas, contaminants and affected media, known and potential routes of contaminant migration, and known or potential human and environmental receptors. Respondent(s) shall use the CSM to assist in the identification of potential SCIAs for the Site and locations where sampling is necessary.

The Workplan shall include soil and ground-water remediation goals for all contaminants previously identified at the Site. Soil remediation goals are not compliance levels. They are developed in order to delineate the Source Areas which the proposed SCIAs must address and to serve as an aid in SCIA design. Soil remediation goals also guide the location of ground-water compliance monitoring point(s). Ground-water remediation goals are developed to establish compliance levels which are then measured in ground water downgradient of the identified Source Areas. They are the ultimate measure of success with respect to the elimination or control of Source Areas of ground-water contamination. The Workplan shall recognize that the development of soil and ground-water remediation goals is an iterative process which is repeated throughout the investigation if contaminants are detected which are not known to be present at the time of Workplan preparation. Soil and ground-water remediation goals shall be developed following the procedures identified below:

A. Identify Contaminants of Concern (COC). COCs are those contaminants detected in ground water and soil at the Site and their associated degradation products. Low relative concentration and infrequent occurrence are insufficient reasons to eliminate contaminants from the COC list.

B. For each COC, identify the corresponding Maximum contaminant Level (MCL) if one exists, and calculate the residential water carcinogenic effects remediation goal (10^{-5}) and the residential water noncarcinogenic effects remediation goal (HI=1) using equations 1' and 2' on pages 21 and 22 of RAGS Part B (see Appendix C). When using equation 1', substitute a target excess individual lifetime cancer risk value of 10^{-5} into the equation. If trichloroethylene is a COC, use the CAL-EPA slope factor of 1.3 x 10^{-2} mg/kg/day for calculation of the residential water carcinogenic effects remediation goal (10^{-5}).

C. For each COC, select the lowest concentration from among the MCL, the carcinogenic risk-based remediation goal, and the noncarcinogenic risk-based remediation goal.

D. For each COC, compare the value obtained in item C above with the practical quantitation limit (PQL) for the contaminant when analyzed using U. S. EPA method 8260 with a 25 ml. purge (or equivalent method). The value obtained in item C becomes the ground-water compliance level unless the PQL is higher in which case the PQL becomes the ground-water compliance level.

E. For each COC, use the value obtained in item C above to calculate soil remediation goals for design purposes using the VLEACH procedure described in exhibit 2.

In the event that no Source Areas are identified though application of the procedures identified in this SOW, Respondent's facility or a portion thereof may, depending on sampling results, be deemed to be a Source Area in which case Respondent shall control migration of contamination located at or attributable to activities conducted at the facility.

Following Ohio EPA approval of the Workplan and supporting documents, Respondent shall implement the work in accordance with the schedules described therein.

1.2 Sampling and Analysis Plan (SAP)

Respondent shall prepare a SAP consisting of the following:

A. Field Sampling Plan (FSP)

The FSP shall specify and detail all activities necessary to obtain Site data and provide detailed standard operating procedures (SOPs) for those activities. The FSP shall describe sampling objectives; equipment and procedures; sample types, locations, and frequencies; and parameters of interest; and shall be tied to the schedules contained in the Workplan.

B. Quality Assurance Project Plan (QAPP)

The QAPP shall address all investigations to be conducted at the Site and shall include the following:

1. A project description;

2. Analytical methods and laboratory procedures;

3. Data quality objectives (DQOs) tied to the intended use(s) for all data proposed for

collection;

4. Quality assurance objectives for data such as the required precision, accuracy, completeness, representativeness, and comparability of data;

5. Chain of custody procedures during sample collection and in the laboratory;

6. The type and frequency of calibration procedures during sample collection and in the laboratory;

7. Preventative maintenance procedures and schedule and corrective action procedures for field and laboratory instruments;

8. Specific procedures to assess data precision, representativeness, comparability, accuracy, and completeness of specific measurement parameters; and

9. Data documentation and tracking procedures.

10. The modeling section of the QAPP shall apply to all models used in the conduct of the FSC/CD and shall be consistent with the U.S. EPA document *"Guidance for Quality Assurance Project Plans for Modeling"* referenced in Appendix C.

C. *Health and Safety Plan*

Respondent shall submit an HSP which shall comply with the requirements of applicable federal, state, and local laws. The HSP shall identify problems or hazards that may be encountered and their solution. Safety procedures to be followed to protect third parties, such as visitors or the surrounding community, including monitoring, shall also be provided. While Ohio EPA may review and provide comment on the HSP, the document is not subject to formal agency approval. At a minimum, the HSP shall be consistent with:

1. NIOSH Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (1985);

2. Section 111c)(6) of CERCLA;

3. U.S. EPA Order 1440.3 -- Respiratory Protection;
4. U.S. EPA Occupational Health and Safety Manual;

5. U.S. EPA Interim Standard Operating Safety Procedures and other U.S. EPA guidance as developed;

6. OSHA regulations, particularly in 29 CFR 1910 and 1926;

7. State and local regulations; and

8. Site or facility conditions.

2.0 SITE INVESTIGATION AND CONCEPTUAL DESIGN

Respondent shall collect data on the physical and chemical characteristics of the Site to the extent necessary to delineate potential Source Areas, evaluate pathways of contaminant migration, and provide sufficient data for screening and selecting proposed SCIAs. Respondent shall screen the potential SCIAs identified in the Workplan concurrent with the Site characterization tasks.

2.1 Hydrogeology

Respondent shall perform a Site-wide hydrogeologic study to characterize the subsurface geology and water bearing formations, ground-water contamination, and pathways of contaminant migration. The study shall determine the location of water bearing formations, confining layers, bedrock, and other subsurface geologic features, and shall support the determination of the vertical and horizontal extent of Source Areas and distribution of source contaminants. Efforts shall begin with a survey of previous hydrogeologic studies and other existing data.

A detailed technical description of all methods to be used in gathering data for this task shall be included in the Workplan. This shall include a diagrammatic representation of proposed field survey, monitoring well, and piezometer locations, monitoring well and piezometer design and construction details, drilling techniques, well development and sampling methods.

The hydrogeologic investigation shall provide the following information for the Site:

A. A representative and accurate classification and description of the hydrogeologic units which may be part of the contaminant Source Areas or pathways of contaminant migration (i.e., the aquifers and any intervening saturated and unsaturated units) including but not limited to:

   1. Hydraulic conductivity (vertical and horizontal) and porosity (total and effective);

   2. Storativity and transmissivity;

   3. Lithology, grain size, sorting, and degree of cementation;
   4. A determination of hydraulic interconnections between saturated zones; and

   5. The retardation potential and composition of native aquifer materials (e.g., organic carbon content, clay content, clay mineralogy, etc.).

B. Hydrogeologic cross-sections showing the extent (depth, thickness, lateral extent) of hydrogeologic units which may be part of the contaminant Source Areas or pathways of contaminant migration, identifying:

   1. Sand, gravel, and other unconsolidated deposits;

   2. Zones of higher or lower permeability that might direct or restrict the flow of

contaminants;

3. Aquifers: geologic formations, groups of formations, or parts of formations capable of yielding usable amounts of ground water to wells or springs; and

4. Water-bearing zones that may serve as a pathway for contaminant migration including perched zones of saturation.

C. A representative description of water level or fluid pressure monitoring including:

1. Potentiometric surface maps;

2. Hydrogeologic cross sections showing vertical gradients and interconnection between water bearing strata; and

3. Temporal changes in hydraulic gradients and flow directions.

D. A description of man-made influences that may affect the hydrogeology of the Site or act as pathways of contaminant migration identifying:

1. Active and inactive local water supply and production wells with an approximate schedule of pumping; and

2. Man-made hydraulic structures (pipe-lines, french drains, ditches, unlined ponds, septic tanks, wastewater outfalls, retention areas, utility lines, etc.).

Respondent shall document the procedures used in making the above determinations.

2.2 Soil and Sediments Investigations

Respondent shall conduct an investigation to characterize the soil and unconsolidated deposits in the vicinity of the contaminant release(s). This process may overlap with certain aspects of the hydrogeologic study (e.g., characteristics of soil strata are relevant to both the transport of contaminants by ground water and to the locations of contaminants in the vadose zone). A survey of existing data on soils and sediments may be useful. The characterization shall include as appropriate the following information:

A. Soil classification using the Unified Soil Classification System;

B. Surface soil distribution;

C. Soil profile;

D. Transects of soil stratigraphy;

E. Hydraulic conductivity;

F. Relative permeability;

G. Bulk density;

H. Porosity;

I. Soil sorptive capacity;

J. Soil organic content;

K. Particle size distribution;

L. Depth to water table and any perched zones;

M. Moisture content;

N. Effect of stratification on unsaturated flow;

O. Infiltration rate;

P. Storage capacity; and

Q. Clay mineralogy.

Respondent shall describe in detail the procedures used in making the above determinations.

2.3 Contamination Characterization

Respondent shall identify and characterize contamination of Site ground water, soils, and soil vapors to the extent necessary to delineate contaminant Source Areas, define and evaluate pathways of contaminant migration, and complete the determination of soil and ground-water remediation goals. Data collected shall be sufficient to define the magnitude, origin, direction, and rate of contaminant migration.

A. Ground-water Contamination

Respondent shall conduct an investigation to characterize ground-water contamination which shall at a minimum provide the following information:

1. A characterization of any immiscible or dissolved phase contaminant plume(s) originating from the Site including non-aqueous phase liquids (NAPLs);

2. The velocity of contaminant movement;

3. The horizontal and vertical concentration profiles of contaminants in identified plumes;

4. An evaluation of factors influencing contaminant movement; and

5. Background contaminant concentrations in areas upgradient of and unaffected by Site-related contamination.

B. Soil Contamination

Respondent shall conduct an investigation to characterize surface and subsurface soil contamination at the Site. The investigation shall be designed to collect the following information:

1. The vertical and horizontal concentration profiles of contaminants in Site vadose and phreatic soils;

2. A description of soil chemical properties which might affect contaminant migration and transformation;

3. Identification of contaminants present;

4. Background soil contaminant concentrations in areas unaffected by Site-related contamination.

C. Soil Vapor Contamination

Consistent with the guidance in Appendix C, Respondent(s) shall evaluate the soil vapor intrusion pathway. If the soil vapor intrusion pathway evaluation indicates that an unacceptable threat to human health exists, Respondent(s) shall promptly mitigate the threat. This evaluation shall at a minimum provide the following information:

1. A survey of representative inhabitable structures in the area near the contaminant source(s) including potential preferential pathways of contaminant migration (e.g., fractures, macropores, utility conduits, and subsurface drains that intersect vapor sources or vapor migration pathways). For the purposes of this task, "inhabitable structures" shall mean residential dwellings and commercial/industrial buildings that have been built for, and are suitable for, occupancy by humans;

2. A screening evaluation of the soil vapor intrusion pathway to determine whether the soil vapor intrusion pathway presents a threat to human health;

3. A proposal for soil vapor and/or indoor air sampling to verify the results of the screening evaluation.

2.4 Focused Site Characterization Report

Respondent shall summarize all investigations and their results to ensure that the investigation data are sufficient in quality and quantity to describe the nature and extent of identified Source Areas, define and evaluate contaminant migration pathways, and support the selection and design of proposed SCIAs. Any data gaps shall be identified and their impact upon the work shall be fully described.

The analysis and summary shall be presented in a written report which shall at a minimum include the following:

A. Data on Site physical characteristics (soils, geology, hydrogeology, etc.)

B. Data on Source Area characteristics describing:

1. Source Area location(s);

2. The type and integrity of any existing waste containment; and

3. A description and diagrammatic representation (planar and cross section) of the vertical and horizontal extent of contamination in the Source Areas (approximate quantity of contaminated source media) based on the soil remediation goals.

C. A description and diagrammatic representation of actual and potential contaminant migration pathways.

D. Soil and ground-water remediation goals and supporting calculations.

2.5 Conceptual Design Report

Respondent(s) shall prepare a Conceptual Design (CD) Report to be submitted concurrently with or as part of the FSC Report. The CD Report shall conduct include an individual and comparative analysis of the potential SCIAs identified in the Workplan, identification of Respondent(s) recommended SCIAs for implementation at the Site, and a conceptual design of Repondent(s)' recommended SCIAs.

Respondent(s) shall use the following criteria to conduct the individual and comparative analysis of potential SCIAs:

A. Time required for implementation;

B. Time required to achieve protection of human health and the environment;

B. Time required to achieve remediation goals;

D. Compliance with federal, state and local laws and regulations;

E. Performance efficiencies;

F. Use of treatment technologies which significantly reduce toxicity, mobility, and volume of contaminants;

G. Ability to minimize or eliminate cross-media transfer of contaminants;

H. Ability to verify SCIAs effectiveness;

I. Frequency of routine maintenance and component replacement;

J. Degree of permanence; and

K. Cost.

The CD Report shall include, but not necessarily be limited to, the following:

A. A comparative evaluation of potential SCIAs considering the factors identified above;

B. A narrative description of the proposed SCIAs;

C. Schematic drawings of treatment processes;

D. A description of how treatment, storage, and disposal of contaminated media will comply with sound engineering practices and all applicable regulatory requirements;

E. Supporting data and documentation defining the functional aspects of the SCIAs;

F. Design calculations including removal and destruction efficiencies for all SCIA components (treatment works, extraction wells, vadose gases extraction networks, etc.);

G. A Site map and cross sections showing the location of all SCIA components and significant Site features;

H. A schedule for submittal of detailed plans and specifications for Respondent's recommended SCIAs including any required permit applications, initiation and completion of construction, attainment of operational level; and initiation of operation, maintenance, and monitoring; and

I. Identification and assessment of all applicable regulatory requirements pertaining to the proposed SCIAs including:

1. Identification of permitting authorities,

2. Required construction/operation permits,

3. Time required by permitting authorities to process applications,

4. Monitoring and/or compliance testing requirements, and

5. Reporting requirements.

J. Monitoring requirements to verify system effectiveness.

3.0 SCIA DESIGN and IMPLEMENTATION

Respondent shall submit plans and any required permit applications for the SCIAs in accordance with the schedule in the approved CD Report.

3.1 Detailed Plans and Specifications

The Detailed Plans and Specifications (DPS) for the approved SCIAs shall be submitted in accordance with the schedule contained in the Ohio EPA-approved FSC/CD. The DPS Report shall include but not be limited to final construction drawings, specifications, plans, and design analyses with supporting calculations. Applications for any required permits shall be submitted simultaneously with the DPS Report. Following Ohio EPA approval of the DPS Report and receipt of any necessary construction permits, Respondent(s) shall initiate construction of the approved SCIAs in accordance with the schedules contained in the Conceptual Design Report.

3.2 Operation and Maintenance (O&M) Plan

An O&M plan shall be submitted to Ohio EPA prior to the completion of construction. Appropriate elements are listed in Exhibit 1. Plan elements listed in Exhibit 1 are for illustrative purposes and should not limit the content of the O&M plan.

3.3 Design Changes During Construction

During construction, unforeseen site conditions, changes in estimated quantities, and other problems associated with the project may require either major or minor changes to the approved design. Design changes require prior approval of Ohio EPA and may require modification of permit(s) to install to ensure that the intent and scope of the approved SCIAs is maintained. Changes to the SCIAs design which require Ohio EPA approval prior to implementation include:

A. Those which involve the deletion or addition of a major component of the approved SCIAs (e.g. changing one treatment system for another, changing from in-situ to ex-situ remediation);

B. Those which result in a less effective treatment for wastes associated with the Site;

C. Any changes which may result in an increased exposure to Site contaminants and/or risk to human health or the environment;

D. Those which result in a significant delay in the completion of the SCIAs; and

E. Any other changes which alter the scope or objectives of the approved SCIAs.

3.4 Construction Completion

As the construction of the SCIAs nears completion, the following activities shall be completed by Respondent to ensure proper construction completion and transition to the O&M phase.

A. Construction Certification Report

A Construction Certification Report (CCR) shall be prepared and submitted by Respondents within 30 days of completion of construction and in accordance with the schedule contained in the Conceptual Design. The CCR report shall include the following:

1. A synopsis of the construction work defined in the detailed plans and specifications and certification that this work was performed;

2. An explanation of any modifications to the work defined in the detailed plans and specifications and why they were necessary for the project;

3. Certification that the constructed SCIAs is operational and functional and constructed according to the approved plans and specifications; and

3. Demonstration that any permits required to operate the constructed SCIAs have either been obtained or applied for in a timely manner.

EXHIBIT 1

Basic Elements of an Operation and Maintenance (O&M) Plan

A. Normal O&M

1. Description of tasks for operation
2. Description of tasks for maintenance
3. Description of prescribed treatment or operating conditions
4. Schedules showing the frequency of each O&M task

B. Potential Operating Problems

1. Description and analysis of potential operating problems
2. Sources of information regarding potential operating problems
3. Description of means of detecting problems in the operating systems
4. Common remedies for operating problems

C. Routine Monitoring and Laboratory Testing

1. Description of monitoring tasks
2. Description of required laboratory tests and interpretation of test results
3. Required QA/QC procedures
4. Monitoring schedule

D. Alternative O&M

1. Description of alternate procedures to prevent undue hazard, should systems fail
2. Vulnerability analysis and additional resources requirements should a failure occur

E. Safety Plan

1. Description of safety procedures, necessary equipment, etc. for site personnel
2. Description of safety tasks required in the event of systems failure

F. Equipment

1. Description of equipment necessary to the O&M Plan
2. Description of installation of monitoring components
3. Description of maintenance of site equipment
4. Replacement schedule for equipment and installed components

G. Records and Reporting Mechanisms Required

1. Daily operating logs
2. Laboratory records
3. Mechanism for reporting emergencies
4. Personnel and maintenance records
5. Monthly reports to Ohio EPA

EXHIBIT 2

METHOD TO EVALUATE THE IMPACT OF VOLATILE ORGANIC COMPOUND CONTAMINATED SOILS ON GROUND-WATER RESOURCES

This document describes a method for evaluating the impact of volatile organic compound contaminated soils on ground-water resources at hazardous waste sites. The method calculates the maximum mass of contaminant that can be transported from the vadose zone to ground water without ground-water contaminant levels exceeding ground-water remediation goals and evaluates how different contaminant concentrations impact the rate at which contaminants are transported from the vadose zone to ground water. The impact of contaminants leaching from the vadose zone to ground water can be evaluated for each contaminant of concern.

The method consists of two steps. In step 1, the maximum mass flux for the contaminant of concern is calculated by setting the contaminant concentration in the top 10 feet of the aquifer beneath the contaminated portion of the site to the ground-water remediation goal, estimating the vertical and horizontal components of ground-water flow, and determining by mass balance calculations the maximum contaminant mass which can be transported via liquid advection and gaseous diffusion to ground water beneath the site without exceeding the ground-water remediation goal.

In step 2, VLEACH, a one-dimensional finite difference vadose zone leaching model, is used to evaluate the impact of soil contaminant concentrations on the transport of contaminants from the vadose zone to ground water.

Step 1. Calculate maximum mass flux for each contaminant.

A simple ground-water flow model is constructed for the site. The model assumes that Darcy's Law

$$Q = -KA\frac{dh}{dl}$$

where K = hydraulic conductivity

A = area

$\frac{dh}{dl}$ = hydraulic gradient

as expressed below is valid.
The model is constructed as follows.

1. Measure the surface area of the contaminated portion of the site.

2. Measure the cross-sectional width of the contaminated area perpendicular to the direction of

ground-water flow.

3. Using Darcy's Law, calculate the lateral ground-water flow in the top ten feet of the aquifer beneath the contaminated portion of the site.

4. Calculate the maximum mass of contaminant that can leave the site (ground-water remediation goal times yearly flux).

5. Calculate the infiltration rate through the contaminated portion of the site using the U.S.EPA Help Model.

6. Assuming the upgradient ground water contaminant concentration = 0, calculate the maximum contaminant mass flux rate for contaminants moving from the vadose zone to ground water passing beneath the site such that the ground-water contaminant level will not exceed the ground-water remediation goal.

Step 2. Evaluate the impact of soil contaminant concentrations on contaminant mass flux.

VLEACH is a computer code for estimating the impact due to the mobilization and migration of a sorbed organic contaminant located in the vadose zone on the underlying ground-water. The code was developed by CH2M Hill for the United States Environmental Protection Agency (USEPA). The most recent version 2.0 can be obtained from U.S. EPA's Center for Subsurface Modeling Support in Ada, Oklahoma.

VLEACH describes the movement of an organic contaminant within and between three different phases: (1) as a solute dissolved in water, (2) as a gas in the vapor phase, and (3) as an adsorbed compound in the solid phase. In particular, VLEACH simulates vertical transport by advection in the liquid phase and by gaseous diffusion in the vapor phase.

These processes are conceptualized as occurring in a number of distinct, user-defined polygons that are vertically divided into a series of cells. Variables such as soil properties, recharge rate, contaminant concentration, and depth to water table are specified for each polygon. Within each polygon homogeneous conditions are assumed except for contaminant concentration, which can vary between layered cells.

VLEACH calculates the mass of contaminant transported to ground water per the user-defined time period. Through an iterative "back calculation" procedure, one can evaluate the ground-water impact of differing vertical arrays of contaminant concentrations until one or more vertical arrays are found which do not result in the exceedance of the ground-water remediation goals.

Appendix B

STATEMENT OF WORK (SOW) FOR CONDUCTING GROUND-WATER PLUME DELINEATION AND FOCUSED FEASIBILITY STUDY FOR POTENTIAL PLUME REMEDIAL ACTIONS

PURPOSE:

The purpose of conducting the work described herein is to delineate and characterize any ground-water contaminant plumes which have resulted from the release of contaminants at the Site, and to evaluate any pathways of contaminant migration, including the soil vapor pathway, that may pose an unacceptable current and/or potential future risk to human health or the environment. Successful completion of the required work shall result in the vertical and horizontal delineation of groundwater contaminant plume(s), characterization of potential pathways of contaminant migration, and identification and evaluation of a range of potential plume remedial actions (PRAs) based on the criteria identified in this SOW.

Respondent shall conduct a Plume Delineation/Characterization (PDC) to determine the vertical and horizontal extent and physical and chemical characteristics of ground-water contaminant plumes, identify ground-water remediation goals, characterize and evaluate contaminant migration pathways, and obtain any other data necessary to support the identification and evaluation of potential PRAs for ground-water contaminant plumes and pathways of contaminant migration. Concurrent with the PDC, Respondent(s) shall conduct a Focused Feasibility Study (FFS) to evaluate potential PRAs. Respondent may propose the use of modeling and field screening techniques to guide the PDC and the FFS and to assist in evaluating contaminant migration pathways. Field analytical data meeting appropriate Data Quality Objectives will be required to verify field screening and modeling results.

The PDC and FFS are interactive and are to be conducted concurrently so that the data collected during the plume delineation and characterization influences the identification of and evaluation of the potential PRAs.

TASKS:

1. Develop Work Plan;

2. Conduct field investigations and obtain all other necessary data

3. Evaluate potential PRAs based on the evaluation criteria identified in this SOW.

DELIVERABLES:

1. Work Plan

Appendix B

2-28-06 version

2. Plume Delineation/Characterization Report

3. Pilot/Treatability Study Work Plan(s) and Report(s) (as appropriate)

4. Focused Feasibility Study Report

5. Monthly Progress Reports

1.0 DEVELOP WORK PLAN

Respondent shall submit a PDC/FFS Work Plan, a Sampling and Analysis Plan (SAP) consisting of a Field Sampling Plan (FSP) and a Quality Assurance Project Plan (QAPP), and a Health and Safety Plan (HSP). The Work Plan and supporting documents (with the exception of the HSP) must be approved by Ohio EPA prior to the initiation of field activities.

1.1 Plume Delineation and Characterization/Focused Feasibility Study Work Plan

The PDC/FFS Work Plan (Work Plan) shall be developed in conjunction with the SAP and the HSP although each plan may be submitted under separate cover. The Work Plan shall describe in detail all tasks necessary to perform the work required by this SOW, provide a supporting rationale for performing each task in the manner described, identify the materials and procedures required for each task, and describe the work products to be submitted to the Ohio EPA, including required deliverables and meetings with Ohio EPA, and shall comply with federal, state and local laws and regulations which apply to the work to be performed. The Work Plan shall include a fixed date critical path schedule for accomplishing the required work which extends through and includes submittal of the PDC and FFS Reports.

Based on a review of existing information, Respondent shall include in the Work Plan a summary of the background information for the Site, including geographic location and describing the physiography, hydrogeology, and history of the Site with respect to the use, storage and disposal of contaminants. The Work Plan shall describe any previous response actions conducted by local, state, federal, or private parties; provide a summary of existing data in terms of the physical and chemical characteristics of identified contaminants; describe their distribution among the environmental media; identify known or potential contaminant Source Areas; and identify known or potential contaminant migration pathways and receptors, including any public or private water supply production wells that may potentially be at risk. Based on this information, Respondent shall develop and include in the Work Plan a Conceptual Site Model (CSM) which identifies known or suspected contaminant Source Areas, contaminants and affected media, known and potential routes of contaminant migration, and known or potential human and environmental receptors. Respondent shall use the CSM to assist in the identification of locations where sampling is necessary and to support the evaluation of potential PRAs in the FFS.

The Work Plan shall include ground-water remediation goals for all contaminants previously identified at the Site. Ground-water remediation goals assist in plume delineation and support the evaluation of potential PRAs in the FFS. The Work Plan shall recognize that the identification of ground-water remediation goals is an iterative process which is repeated throughout the investigation if contaminants are detected which are not known to be present at the time of Work Plan preparation. Ground-water remediation goals shall be developed using the following procedures:

A. Identify contaminants of Concern (COC). COCs are those contaminants detected in ground water and soil at the Site and their associated degradation products. Low relative concentration and infrequent occurrence are insufficient reasons to eliminate contaminants from the COC list.

B. For each COC, identify the corresponding Maximum Contaminant Level (MCL) if one exists, and calculate the residential water carcinogenic effects remediation goal (10^{-5}) and the residential water noncarcinogenic effects remediation goal (HI=1) using equations 1' and 2' on pages 21 and 22 of RAGS Part B (see Appendix C). When using equation 1', substitute a target excess individual lifetime cancer risk value of 10^{-5} into the equation. If trichloroethylene is a COC, use the CAL-EPA slope factor of 1.3×10^{-2} mg/kg/day for calculation of the residential water carcinogenic effects remediation goal (10^{-5}).

C. For each COC, select the lowest concentration from among the MCL, the carcinogenic risk-based remediation goal, and the noncarcinogenic risk-based remediation goal.

D. For each COC, compare the value obtained in item C above with the practical quantitation limit (PQL) for the contaminant when analyzed using U. S. EPA method 8260 with a 25 ml. purge (or equivalent method). The value obtained in item C becomes the ground-water remediation goal unless the PQL is higher, in which case the PQL becomes the ground-water remediation goal.

The Work Plan shall also identify general ground-water response actions which address the following ground-water response objectives:

1. Prevent exposure to contaminated ground water;
2. Protect uncontaminated ground and surface water for current and future use; and
3. Restore contaminated ground water for future use.

General ground-water response actions shall be identified which not only address preliminary ground-water remediation goals, but the time frame within which the remediation goals might be achieved. The range of general ground-water response actions shall include actions which actively remediate ground-water contaminant plume(s). The use of presumptive remedy guidance, as appropriate, may provide an immediate focus to the identification of general ground-water response actions at this stage. Presumptive remedies involve the use of remedial technologies that have been consistently selected at similar sites or for similar contamination. Data collection and analysis activities necessary to support the detailed analysis of potential PRAs shall be included in the Work Plan.

Following Ohio EPA approval of the Work Plan and supporting documents, Respondent(s) shall implement the work in accordance with the schedules described therein.

1.2 *Sampling and Analysis Plan (SAP)*

Respondent shall prepare a SAP consisting of the following:

A. *Field Sampling Plan (FSP)*

The FSP shall specify and detail all activities necessary to obtain data for the Site and provide detailed standard operating procedures (SOPs) for those activities. The FSP shall describe sampling objectives; equipment and procedures; sample types, locations, and frequencies; and parameters of interest; and shall be tied to the schedules contained in the Work Plan.

B. *Quality Assurance Project Plan (QAPP)*

The QAPP shall address all investigations to be conducted at the Site, including but not limited to the following:

1. A project description;

2. Analytical methods and laboratory procedures;

3. Data Quality Objectives (DQOs) tied to the intended use(s) for all pre-existing and all data proposed for collection;

4. Quality assurance objectives for data such as the required precision, accuracy, completeness, representativeness, and comparability of data;

5. Chain of custody procedures during sample collection and in the laboratory;

6. The type and frequency of calibration procedures during sample collection and in the laboratory;

7. Preventative maintenance procedures and schedule and corrective action procedures for field and laboratory instruments;

8. Specific procedures to assess data precision, representativeness, comparability, accuracy, and completeness of specific measurement parameters; and

9. Data documentation and tracking procedures.

10. The modeling section of the QAPP shall apply to all models used in the conduct of the PDR and shall be consistent with the U.S. EPA document *"Guidance for Quality Assurance Project Plans for Modeling"* referenced in Appendix C.

C. *Health and Safety Plan (HSP)*

Respondent shall submit a HSP which complies with the requirements of applicable federal, state, and local laws. The HSP shall identify problems or hazards that may be encountered at the Site and describe in detail each related mitigation procedure. The HSP shall include procedures for protecting third parties such as visitors and the surrounding community. Ohio EPA may provide comment on the HSP, however the HSP is not subject to formal agency approval. The HSP should be consistent with:

1. NIOSH Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (1985);

2. Section 111©)(6) of CERCLA;

3. U.S. EPA Order 1440.3 -- Respiratory Protection;

4. EPA Order 1440.2 -- Health and Safety Requirements for Employees Engaged in Field Activities;

5. U.S. EPA Occupational Health and Safety Manual;

6. U.S. EPA Standard Operating Safety Guides (Publication 9285.1-03, PB92-963414, June 1992;

7. OSHA regulations, particularly in 29 CFR 1910 and 1926;

8. State and local regulations; and

9. Facility and Site conditions.

2.0 PLUME DELINEATION AND CHARACTERIZATION

Respondent shall collect sufficient data on the physical and chemical characteristics of the Site to characterize and delineate any ground-water contaminant plumes and any pathways of contaminant migration. Respondent shall also collect such data as may be required to support the analysis of potential PRAs in the FFS.

2.1 Hydrogeologic Study

Respondent shall perform a hydrogeologic study throughout the Site to evaluate the subsurface geology and water bearing formations, and to delineate/characterize ground-water contamination and pathways of contaminant migration. The study shall determine the location of water bearing formations, confining layers, bedrock, and other subsurface geologic features, and shall support the determination of the vertical and horizontal extent of contaminant plumes and distribution of plume contaminants. Efforts shall begin with a survey of previous hydrogeologic studies and other existing data.

A detailed technical description of all methods to be used in gathering data for this task shall be included in the Work Plan and supporting documents. This shall include a diagrammatic representation of proposed field survey, monitoring well, and piezometer locations, monitoring well and piezometer design and construction details, drilling techniques, well development and sampling methods.

The hydrogeologic investigation shall provide the following information for the Site:

A. A representative and accurate classification and description of the hydrogeologic units which may be part of the contaminant plume or pathways of contaminant migration (i.e., the aquifers and any intervening saturated and unsaturated units) including but not limited to:

    1. Hydraulic conductivity (vertical and horizontal) and porosity (total and effective);

    2. Storativity and transmissivity;

    3. Lithology, grain size, sorting, and degree of cementation;

    4. A determination of hydraulic interconnections between saturated zones; and

    5. The retardation potential and composition of native aquifer materials (e.g., organic carbon content, clay content, clay mineralogy, etc.).

B. Hydrogeologic cross-sections showing the extent (depth, thickness, lateral extent) of hydrogeologic units which may influence the contaminant plume or pathways of contaminant migration, identifying:

1. Sand, gravel, and other unconsolidated deposits;

2. Zones of higher or lower permeability that might direct or restrict the flow of contaminants;

3. Aquifers: geologic formations, groups of formations, or parts of formations capable of yielding usable amounts of ground water to wells or springs; and

4. Water-bearing zones that may serve as a pathway for contaminant migration including perched zones of saturation.

C. A representative description of water level or fluid pressure monitoring including:

1. Potentiometric surface maps;

2. Hydrogeologic cross sections showing vertical gradients and interconnection between water bearing zones; and

3. Temporal changes in hydraulic gradients and flow directions.

D. A description of man-made influences that may affect the hydrogeology of the Site or act as pathways of contaminant migration identifying:

1. Local water supply and production wells with an approximate schedule of pumping; and

2. Man-made hydraulic structures (*e.g.*, pipe-lines, french drains, ditches, unlined ponds, septic tanks, wastewater outfalls, retention areas, utility lines, etc.).

Respondent shall document the procedures used in making the above determinations.

2.2 Soil and Sediments Investigation

Respondent shall conduct a program to characterize the soil and unconsolidated deposits in the vicinity of the Site. This process may overlap with certain aspects of the hydrogeologic study. A survey of existing data on soils and sediments may be useful. The characterization shall include as appropriate the following information:

A. Soil classification using the Unified Soil Classification System;

B. Surface soil distribution;

C. Soil profile;

D. Transects of soil stratigraphy;

E. Hydraulic conductivity;

F. Relative permeability;

G. Bulk density;

H. Porosity;

I. Soil sorptive capacity;

J. Soil organic content;

K. Particle size distribution;

L. Depth to water table and any perched zones;

M. Moisture content;

N. Effect of stratification on unsaturated flow;

O. Infiltration rate;

P. Storage capacity; and

Q. Clay mineralogy.

Respondent shall describe in detail the procedures used in making the above determinations.

2.3 Contamination Characterization

Respondent shall identify and characterize ground-water contamination to the extent necessary to define contaminant plumes and pathways of contaminant migration, and complete the determination of ground-water remediation goals. Data collected shall be sufficient to define the magnitude, origin, direction, and rate of contaminant migration.

A. Ground-water Contamination

Respondent shall conduct an investigation to delineate/characterize ground-water contamination which shall at a minimum provide the following information:

1. A characterization of any immiscible or dissolved phase contaminant plumes including non-aqueous phase liquids (NAPL);

2. The velocity of contaminant movement;

3. The horizontal and vertical concentration profiles of contaminants within ground-water contaminant plumes;

4. An evaluation of factors influencing contaminant movement;

5. Background conditions in areas upgradient of and unaffected by Site related contamination; and

6. Identification of any public or private water supply wells potentially affected by ground-water contaminant plumes and the concentration of contaminants in such wells.

Respondent shall document the procedures used in making the above determinations. Respondent shall refer to the guidance identified in Appendix C for well design, construction, development, purging, sampling, geophysics, modeling, etc

B. Soil Vapor Contamination

Consistent with the guidance included in Appendix C, Respondent shall evaluate the soil vapor intrusion pathway. If the soil vapor intrusion pathway evaluation indicates that an unacceptable threat to human health exists, Respondent shall promptly mitigate the threat. The evaluation shall at a minimum provide the following information:

1. A survey of representative inhabitable structures in the area overlying the ground-water contaminant plume. For the purposes of this task, "inhabitable structures" shall mean residential dwellings and commercial/industrial buildings that have been built for, and are suitable for, occupancy by humans;

2. A screening evaluation of the soil vapor intrusion pathway to determine whether the soil vapor intrusion pathway presents a potential threat to human health;

3. A proposal for soil vapor and/or indoor air sampling to verify the results of the screening evaluation.

2.4 *Potential Plume Remedial Action Array*

Respondent(s) began the development and evaluation of a limited number of potential PRAs during preparation of the PDC/FFS Work Plan. Based on the data collected during the PDC, Respondent(s) shall refine the potential PRAs as described below.

2.4.1 *Development and Screening of Potential Plume Remedial Actions*

A. Refine Potential PRAs

Concurrent with Site characterization activities, Respondent(s) shall refine the initial identification of general ground-water response actions performed in the PDC/FFS Work Plan as additional data from the Site become available. All potential response actions under consideration must at a minimum ensure protection of human health and the environment. Refined potential PRAs shall be described with respect to treatment, pumping, containment, or other actions, singly or in combination, to meet the ground-water response objectives identified in 1.1 above.

B. Identify Areas and/or Volumes of Media

Respondent(s) shall identify areas or volumes of media to which the potential general ground-water response actions apply, taking into account the preliminary ground-water remediation goals, site conditions, and the nature and extent of contamination. (Section 4.2.3 of the RI/FS Guidance).

C. Identify, Screen, and Document Remedial Technologies

Respondent(s) shall screen and evaluate remedial technologies associated with the general ground-water response actions in order to eliminate those that cannot be technically implemented at the Site based on contaminant types and concentrations and Site characteristics. Decisions made during the screening of remedial technologies and supporting rationale shall be documented in the PDC Report.

D. Evaluate and Document Process Options

Process options for each technology type shall be identified and evaluated on the basis of effectiveness, implementability, and cost as those criteria are defined in Section 4.2.5 of U.S. EPA's RI/FS Guidance. The intent shall be to select and retain wherever possible one or, if necessary, more representative process options for each implementable technology type. Evaluation should typically focus on effectiveness factors at this stage with less effort directed at the implementability and cost factors. The identification and screening of technology types and process options shall be documented for inclusion in the PDC Report, including the rationale for screening technologies and process options from further consideration.

2.4.2 *Assembly of Representative Technologies into Potential Plume Remedial Actions*

Respondent(s) shall assemble the selected representative technologies into potential PRAs, each of which comprehensively addresses the delineated contaminant plume(s). A potential PRA shall be included for ground water that is a current or potential source of drinking water which achieves the preliminary ground-water remediation goals throughout the delineated plume(s) within the shortest time frame technically practicable. A limited number of additional PRAs shall be developed that attain the ground-water cleanup goals within different restoration time periods using one or more different technologies. Natural attenuation to the preliminary ground-water remediation goals shall serve as a baseline for comparison with other potential PRAs. Each potential PRA shall be described with respect to the locations and areas of the Site affected, approximate volumes of media to be removed or treated, and any other information needed to adequately describe the PRA and document the logic behind the assembly of general response actions and representative remedial technologies into specific potential PRAs.

2.4.3 *Post-Assembly Considerations*

At the conclusion of the assembly of potential PRAs, Respondent(s) shall determine if the amount and type of data existing for the Site will support the detailed analysis of the PRAs. Respondent(s) shall consider whether any additional field investigation or treatability testing is necessary prior to proceeding with the detailed analysis of the potential PRAs. If Respondent(s) determines that additional site data or treatability testing is needed, Respondent(s) shall document that determination, identify the specific types of data needed, the time frame for obtaining the data, and the effect on the overall project schedule. If Ohio EPA concurs with Respondent(s)' determinations, Respondent(s) shall submit for Ohio EPA review and approval such work plans or treatability study plans as may be needed to obtain the additional data. Should Ohio EPA determine, based on review of the PDC Report, that additional data is needed in order to perform the detailed analysis of potential PRAs, Ohio EPA shall notify Respondent(s) of the need for and types of additional data needed. Respondent(s) shall submit for Ohio EPA review and approval such work plans or treatability study plans as may be needed to obtain the additional data.

2.5 *Plume Delineation/Characterization Report*

Respondent(s) shall summarize all investigations and their results to ensure that the investigation data are sufficient in quality and quantity to delineate groundwater contaminant plume(s), define contaminant migration pathways, and support the identification and evaluation of potential PRAs. Any data gaps shall be identified and their impact upon the work shall be fully described.

The analysis and summary shall be presented in a written PDC Report which shall at a minimum include the following:

A. Data on the physical characteristics of the Site (soils, geology, hydrogeology, etc.), including summary tables of relevant results.

B. Data on contaminant source characteristics describing:

1. The contaminant source location(s).

2. The type and integrity of any existing contaminant source containment.

C. Data on ground-water contaminant plumes including a description and diagrammatic representation (planar and cross section) of the vertical and horizontal extent of contamination in ground water based on the identified ground-water remediation goals.

D. An evaluation of the soil vapor migration pathway including data and information supporting the evaluation;

E. A revised Conceptual Site Model identifying all potential or suspected sources of contamination, types and concentrations of contaminants, potential exposure pathways, and all potential receptors. description and diagrammatic representation of actual and potential contaminant migration pathways; and

F. Ground-water remediation goals and supporting calculations for all contaminants identified during the investigation, including potential breakdown products.

G. Potential Plume Remedial Action Array, including documentation of the methods, rationale, and results of the technology, process option, and potential PRA development process.

Based upon the PDC Report, the Ohio EPA shall identify and provide to Respondent(s) ARARs for the range of potential PRAs presented. ARARs are subject to revision throughout the PDC/FFS process and are finalized by Ohio EPA at the time of remedy selection.

3.0 FOCUSED FEASIBILITY STUDY

3.1 *Detailed Analysis of Potential PRAs*

Once it has been determined that sufficient data exist to proceed, Respondent(s) shall conduct the detailed analysis of potential PRAs to provide the Ohio EPA with the information needed for remedy selection. The detailed analysis shall consist of an individual analysis of each potential PRA against the eight evaluation criteria described below and a comparative analysis of all potential PRAs using the same evaluation criteria as a basis for comparison.

The detailed analysis shall consist of the following elements:

3.1.1. *Detailed Description*

The detailed narrative description of each potential PRA shall include as a minimum:

A. Description of appropriate treatment and disposal technologies;

B. Refinement of the volumes and/or areas of contaminated media to be addressed;

C. Special engineering considerations required to implement the potential PRA, *e.g.*, pilot treatment facility or additional studies needed to proceed with final remedial design;

D. Operation, maintenance and monitoring requirements of the completed remedy;

E. Temporary storage requirements;

F. Safety requirements for implementation, including both on-site and off-site health and safety considerations;

G. An analysis of how potential PRAs could be phased into individual operations and a discussion of how these operations could best be implemented (individually or in groups) to produce significant environmental improvement;

H. A review of any off-site treatment or disposal facilities and transportation needs to ensure compliance with RCRA, TSCA and state requirements; and

I. An analysis of the projected performance and expected results of the potential PRA.

3.1.2 *Environmental Impact of potential PRAs*

An assessment of the environmental impact of each potential PRA shall be performed, including the impacts of residual contamination, if any, and the impact of physical/habitat alterations (*eg*: loss of wetlands or riparian habitat due to filling or grading, destruction of benthic substrate, nesting areas, etc). Include any proposals for damage mitigation. Assess in comparison to other potential PRAs.

3.1.3. *Apply Eight Criteria and Document Individual Potential PRA Analysis*

Respondent(s) shall apply the eight evaluation criteria described below to each individual potential PRA. Respondent(s) shall document the decision making process and the results of the individual analysis of potential PRAs for inclusion in the FFS.

A. Overall Protection of Human Health and the Environment.

Potential PRAs shall be assessed as to whether they can adequately protect human health and the environment from unacceptable risks posed by contaminants present at the Site by eliminating, reducing or controlling exposures to levels established during development of the ground-water remediation goals. This is a threshold requirement and the primary objective of the remediation effort.

B. Compliance with Applicable or Relevant and Appropriate Requirements.

The potential PRAs shall be assessed as to whether they attain applicable or relevant and appropriate standards, criteria and requirements of state and federal environmental and public health laws.

C. Long-term Effectiveness and Permanence.

Potential PRAs shall be assessed for the long-term effectiveness and permanence they afford, along with the degree of certainty that the potential PRA will prove successful. Factors that shall be considered, as appropriate, include the following:

1. Nature and magnitude of residual risk following implementation, including an assessment of the potential risk to human and environmental receptors based on the concentrations of contaminants remaining following implementation.

2. The type, degree and adequacy of long-term management required for untreated contaminants and treatment residuals, including engineering controls (such as

containment technologies), institutional controls, monitoring and operation and maintenance;

3. Long-term reliability of the engineering and institutional controls, including uncertainties associated with land disposal of untreated contaminants, as well as treatment residuals, and;

4. Potential need for replacement of the remedy, as well as the continuing need for repairs to maintain the performance of the remedy.

D. Reduction of Toxicity, Mobility or Volume.

The degree to which potential PRAs employ treatment that reduces toxicity, mobility or volume of contaminants shall be assessed. Potential PRAs which, at a minimum, address the principal threats posed by the Site through treatment shall also be identified. Factors that shall be considered, as appropriate, include the following:

1. The treatment or recycling processes employed and materials they will treat;

2. The amount of contaminants destroyed, or treated, or recycled;

3. The degree of expected reduction in toxicity, mobility or volume of the contaminants due to treatment or recycling and the specifications of which reduction(s) are occurring;

4. The degree to which the treatment is irreversible;

5. The type and quantity of residuals that will remain following treatment, considering the persistence, toxicity, mobility and propensity to bioaccumulate;

6. The degree to which treatment will reduce the inherent hazards posed by the principal threats at the Site; and

7. The degree to which the treatment processes employed reduce the transfer of contaminants between environmental media.

E. Short-term Effectiveness.

The short-term impacts of the potential PRAs during the construction and implementation phase, and until the objectives of the remedial action have been met, shall be assessed considering the following:

1. Short-term risks that may be posed to the community during construction and implementation of a potential PRA and until the remedial action objectives have been met;

2. Potential impacts on workers during implementation of the potential PRA including the effectiveness and reliability of protective measures;

3. Potential environmental impacts that may result from implementation of the potential PRA and the effectiveness and reliability of mitigative measures during implementation and until the objectives of the remedial action have been met; and

4. Time until preliminary ground-water remediation goals are achieved.

F. Implementability.

The technical and administrative feasibility of implementing the potential PRAs shall be assessed by considering the following types of factors, as appropriate:

1. Technical Feasibility

-Degree of difficulty or uncertainty associated with construction and operation;

-Expected operational reliability;

-Ease of undertaking additional remedial action(s); and

-Ability to monitor the effectiveness of the remedy.

2. Administrative Feasibility

-Activities needed to coordinate state, local, and federal agencies (e.g., obtaining necessary approvals and permits, right-of-way for construction, etc.); and

-Likelihood of property owner to enter into an environmental covenant.

3. Feasibility of Obtaining Services and Materials

-Capacity and location of adequate treatment, storage, and disposal services;

-Availability of necessary equipment and specialists and provisions to ensure any necessary additional resources; and

-Availability of prospective technologies

G. Cost.

The types of costs that shall be assessed include the following:

1. Direct and indirect capital costs, including contingency and engineering fees;

2. Annual operation and maintenance costs; and

3. Net present value of capital and O&M costs.

H. Community Acceptance.

This assessment includes determining which components of the potential PRAs interested persons in the community support, have reservations about, or oppose. This assessment, which will be completed by the Ohio EPA, occurs throughout the implementation of the PDC/FFS and is completed by Ohio EPA after public comment on the proposed PRA. Evaluation of community acceptance is not part of this Order or SOW.

3.1.4. *Compare Potential PRAs Against Each Other and Document the Comparison of Potential PRAs*

At the conclusion of the individual analysis of potential PRAs, Respondent(s) shall perform a comparative analysis of the potential PRAs. Each potential PRA shall be compared against the others using the eight evaluation criteria described above as a basis of comparison. Respondent(s) shall document the decision making process and the results of the comparative analysis of potential PRAs for inclusion in the FFS. Identification and selection of the preferred PRA is reserved for the Ohio EPA and is not part of the Orders or SOW.

3.15 *Focused Feasibility Study Report*

Respondent(s) shall submit a draft Focused Feasibility Study report to the Ohio EPA for review, comment, and approval. This report shall include the detailed analysis of potential PRAs, clearly documenting the decision making processes and the results. Respondent(s) shall refer to U.S. EPA's Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA for an outline of the report format and the required report content. Upon satisfactorily addressing Ohio EPA's comments, Respondent(s) will prepare and submit a final Focused Feasibility Study Report.

Appendix C

GUIDANCE DOCUMENTS

OHIO EPA POLICIES AND GUIDANCE DOCUMENTS

1. "Remediation Using Monitored Natural Attenuation", Ohio EPA, DERR, Policy No. DERR-00-RR-032, January, 2001

2. "Technical Guidance Manual for Hydrogeologic Investigations and Ground Water Monitoring Programs", Ohio EPA, Division of Drinking and Ground Waters, Final, February 1995 (various updates)

3. "Wastewater Discharges Resulting from Clean-Up of Response Action Sites Contaminated with Volatile Organic Compounds", Ohio EPA Policy No. DSW-DERR 0100.027, Final, September 22, 1994 (updated December 21, 2006)

4. "Sample Collection and Evaluation of Vapor Intrusion to Indoor Air", Ohio EPA, DERR, May 2010

U.S. EPA GUIDANCE DOCUMENTS AND OTHER USEFUL GUIDANCE

5. "Draft Guidance For Evaluating The Vapor Intrusion to Indoor Air Pathway From Groundwater And Soils (Subsurface Vapor Intrusion Guidance)" U.S. EPA, November 2002

6. "Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers," U.S. EPA, EPA 542-S-02-001, May 2002

7. "Compendium of ERT Soil Sampling and Surface Geophysics Procedures," U.S. EPA, OSWER 9360.4-02, January 1991

8. "Guidance for Quality Assurance Project Plans", U.S. EPA, EPA/240/R-02/009 (EPA QA/G-5), December 2002

9. "Guidance for the Data Quality Objective Process," U.S. EPA, EPA/600/R-96/055 (EPA QA/G-4), August 2000

10. "Data Quality Objectives Process for Hazardous Waste Site Investigations", U.S. EPA, EPA/600/R-00/007 (EPA QA/G-4HW), January 2000

11. "Statistical Methods for Evaluating the Attainment of Cleanup Standards, Volume 1: Soils and Solid Media," U.S. EPA, EPA 230/02-89-042. February 1989.

12. "Methods for Evaluating The Attainment Of Cleanup Standards, Volume 2: Ground Water," U.S. EPA, EPA 230-R-92-014 July 1992.

13. "Statistical Methods For Evaluating The Attainment Of Cleanup Standards, Volume 3: Reference-Based Standards For Soils And Solid Media," U.S. EPA, EPA 230-R-94-004, December 1992

14. "Data Quality Assessment: Statistical Methods for Practitioners," U.S. EPA, EPA/240/B-06/003 (EPA QA/G-9S), February 2006

15. "Data Quality Evaluation Statistical Toolbox (DATA Quest) Users Guide," U.S. EPA ORD, EPA/600/R-96/085 (EPA QA/G-9D), December 1997. No longer available. For a links to other free software for performing data quality assessment, see Quality-Related Resources – Software.

16. "Guidance for Quality Assurance Project Plans for Modeling" U.S. EPA OEI, EPA/240/R-02/007 (EPA QA/G-5M), December 2002

17. "Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Ground Water at CERCLA Sites", OSWER Directive 9283.1-12, EPA 540/R-96/023, PB96-963508, October 1996.

18. "Presumptive Remedies: Site Characterization and Technology Selection for CERCLA Sites with Volatile Organic Compounds in Soil," U.S. EPA, OSWER 9355.4-048FS, September 1993

19. "User's Guide to the VOCs in Soils Presumptive Remedy," U.S. EPA, OSWER 9355.0-63FS; EPA 540/F-96/008; PB 96-963308, July, 1996

20. "Presumptive Remedy: Supplemental Bulletin Multi- Phase Extraction (MPE) Technology for VOCs in Soil and Groundwater," U.S. EPA, OSWER 9355.0-68F8, April 1997

21. "Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water," U.S. EPA, EPA/600/R-98/128, September 1998

22. "Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tanks," U.S. EPA, OSWER 9200.4-17, December 1, 1997

23. "Performance Monitoring of MNA Remedies for VOCs in Ground Water," U.S. EPA ORD, EPA/600/R-04/027, April 2004

24. "Region 5 Framework for Monitored Natural Attenuation Decisions for Ground Water," U.S. EPA Region 5, September 19, 2000

25. "Natural Attenuation for Groundwater Remediation," Committee on Intrinsic Remediation, National Academy of Sciences, 2000

26. "Pump-and-Treat Ground-Water Remediation," U.S. EPA ORD, EPA/625/R-95/005, July, 1996

27. "Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration," U.S. EPA, OSWER 9234.2-25, September 1993

28. "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA", EPA/540/G-89/004, OSWER Directive 9355.3-01, October, 1988.

29. "Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites", EPA/540/G-88/003, OSWER Directive 9283.1-2, December, 1988

30. "Data Quality Objectives Process for Superfund", Interim Final Guidance, OSWER Directive 9355.9-01, EPA540-R-93-071, September 1993

31. "Guide for Conducting Treatability Studies Under CERCLA", EPA/540/2-89/058, December 1989, interim final

32. "Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual (Part B), Development of Risk-based Preliminary Remediation Goals," OSWER Directive 9285.7-01B, December 1991, Interim

33. "Integrated Risk Information System Data Base," (IRIS) U.S. EPA,

34. U.S. EPA Health Effects Assessment Summary Tables (HEAST), Office of Emergency & Remedial Response, published annually

35. "U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review", EPA-540/R-99-008, October 1999

36. "VLEACH: A One-Dimensional Finite Difference Vadose Zone Leaching Model, Version 2.2a, USEPA